Magnitude 7.4 OFFSHORE GUATEMALA
Wednesday, November 7, 2012 at 16:35:50 UTC

A major earthquake struck off the Pacific coast of Guatemala Wednesday morning rocking the capital and shaking buildings as far away as Mexico City and El Salvador. The earthquake occurred 24km (15 mi) south of Champerico, Guatemala and 163 km (101 mi) WSW of the capital city Guatemala City, Guatemala.

There are reports of collapsed structures, 48 dead, widespread power outages and loss of telephone service.

Two women walk past a building damaged after a magnitude 7.4 earthquake struck. The mountain village, some 80 miles (130 kilometers) from the epicenter, suffered much of the damage with some 30 homes collapsing in its center. There are three confirmed dead and many missing after the strongest earthquake to hit Guatemala since a deadly 1976 quake that killed 23,000.

(*AP Photo/Moises Castillo*)

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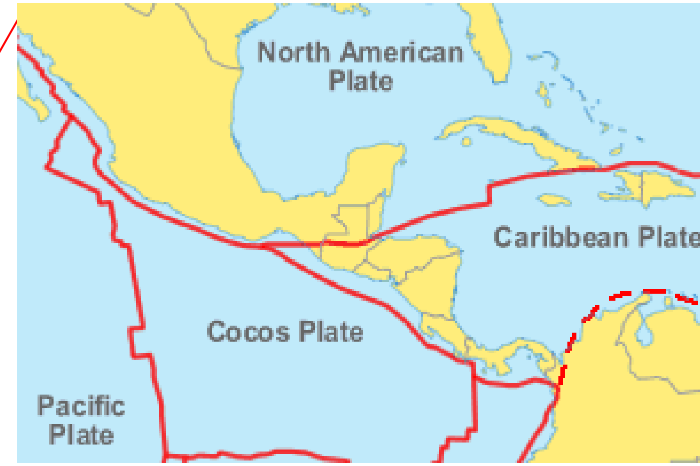
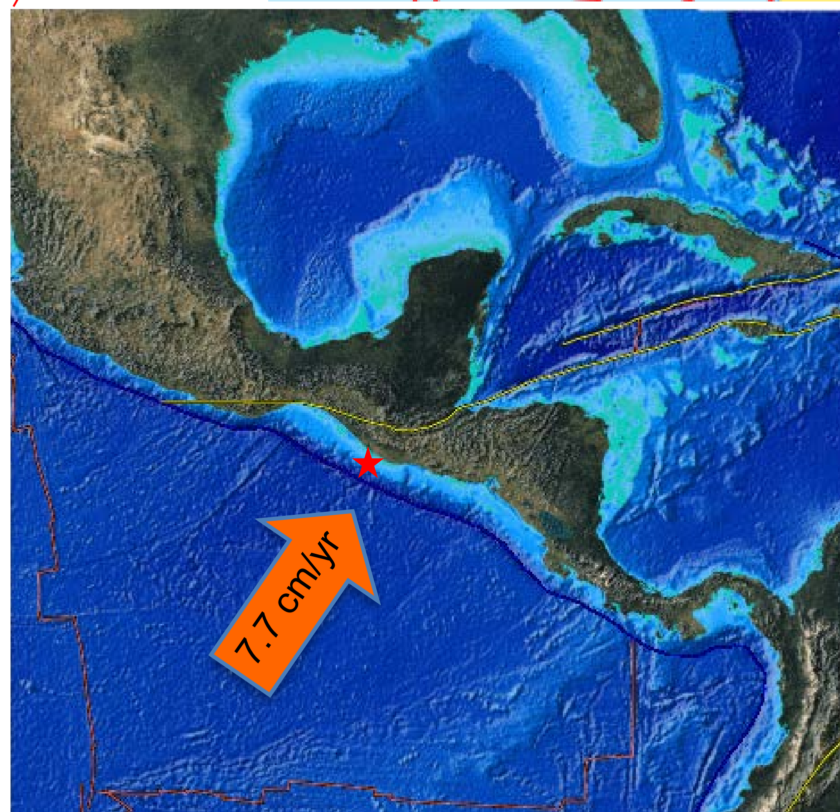


This earthquake occurred as a result of thrust faulting on or near the subduction zone interface between the Cocos and overlying Caribbean plates. (USGS)

At the latitude of this earthquake, the Cocos Plate moves north-northeast with respect to the Caribbean Plate at a velocity of approximately 77 mm/yr, and subducts beneath Central America at the Middle America Trench.



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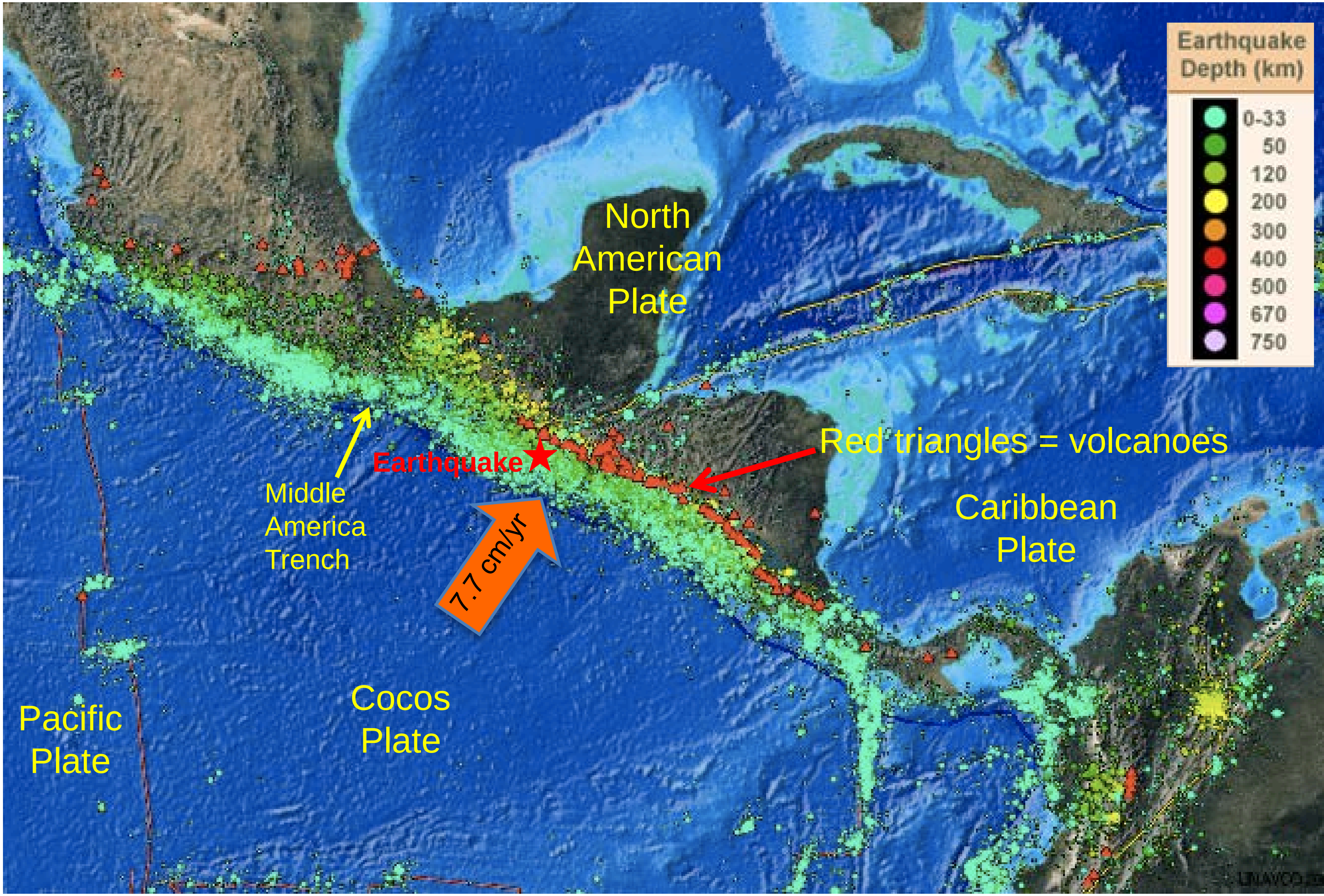

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The earthquake (yellow star) is plotted with epicenters of earthquakes in the region since 1990.

According to the USGS, over the past 40 years, the region within 250 km of this earthquake has experienced 50 earthquakes with magnitude 6 or greater; two of these were larger than magnitude 7.

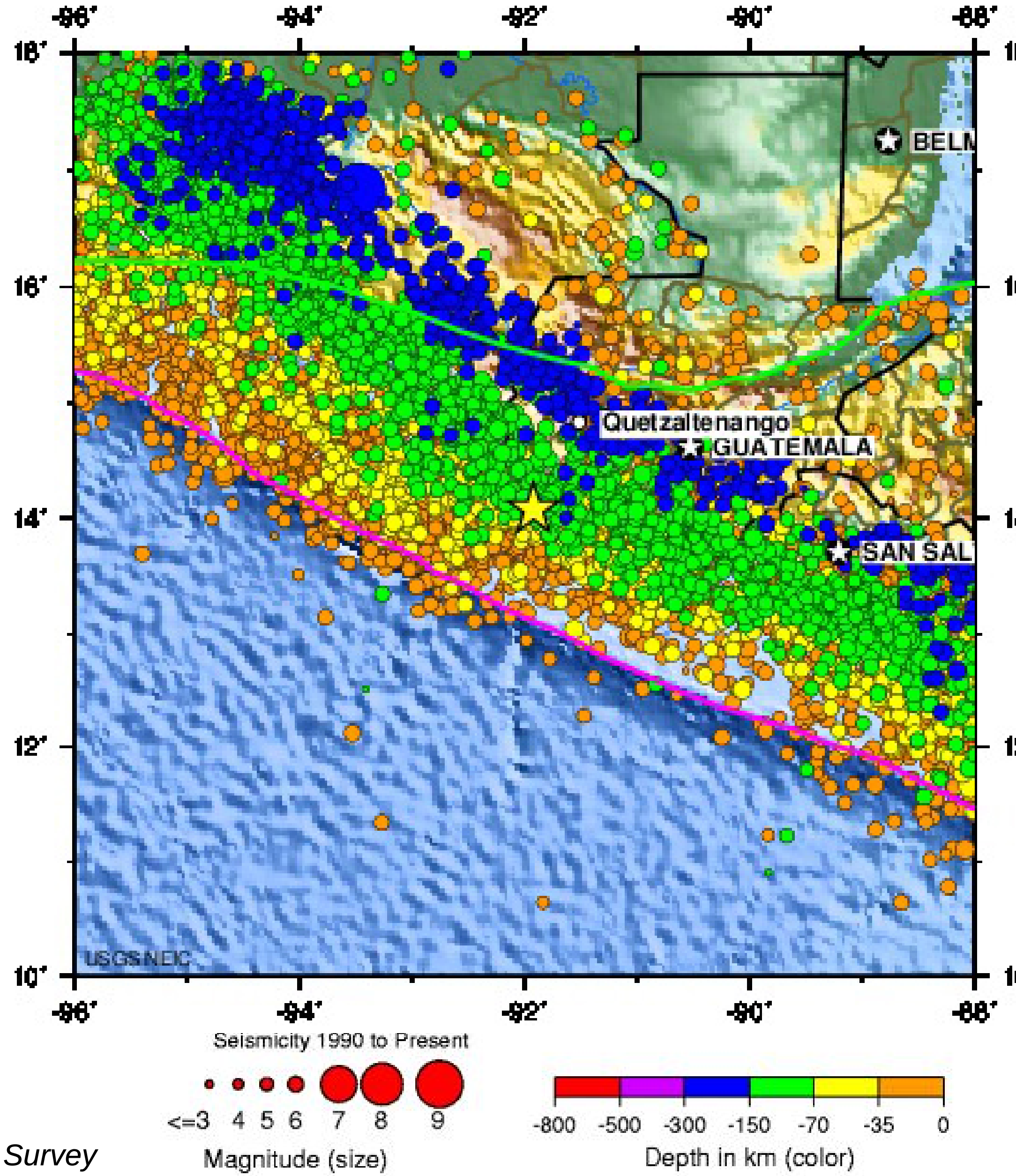

Image courtesy of the US Geological Survey

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The hypocenter of this earthquake was 41.6 km (25.8 miles) deep. For an earthquake of a given magnitude, a deeper event will cause less damage but will be more widely felt. As seismic waves radiate away from the hypocenter, their energy is spread over a larger area of wavefront. Lower energy per unit area of wavefront means that the amplitudes of seismic wave oscillations are smaller.

With a 41.6 kilometer depth of hypocenter, amplitudes of the ground surface oscillations produced by this Guatemala event were much less than would have occurred had the hypocenter been closer to the surface. For comparison, the hypocenter of the M7.0 Haiti earthquake in 2010 was only 10 km deep.

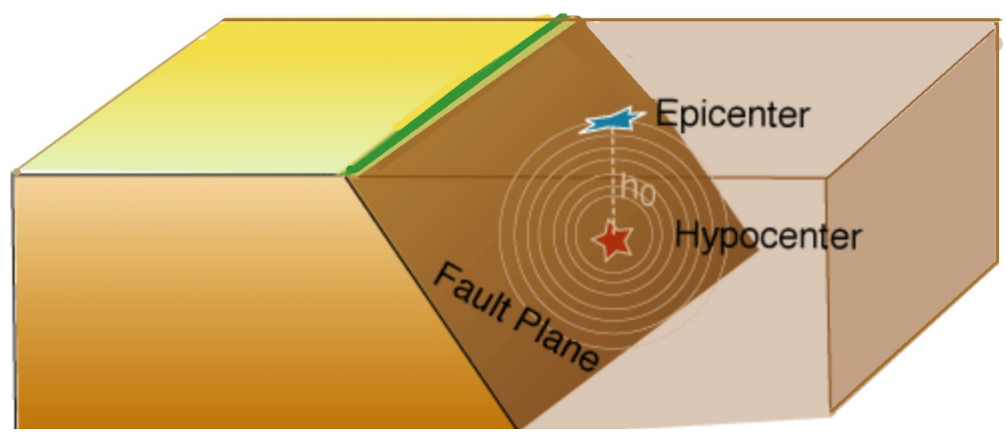

Image courtesy of quakeinfo.ucsd.edu

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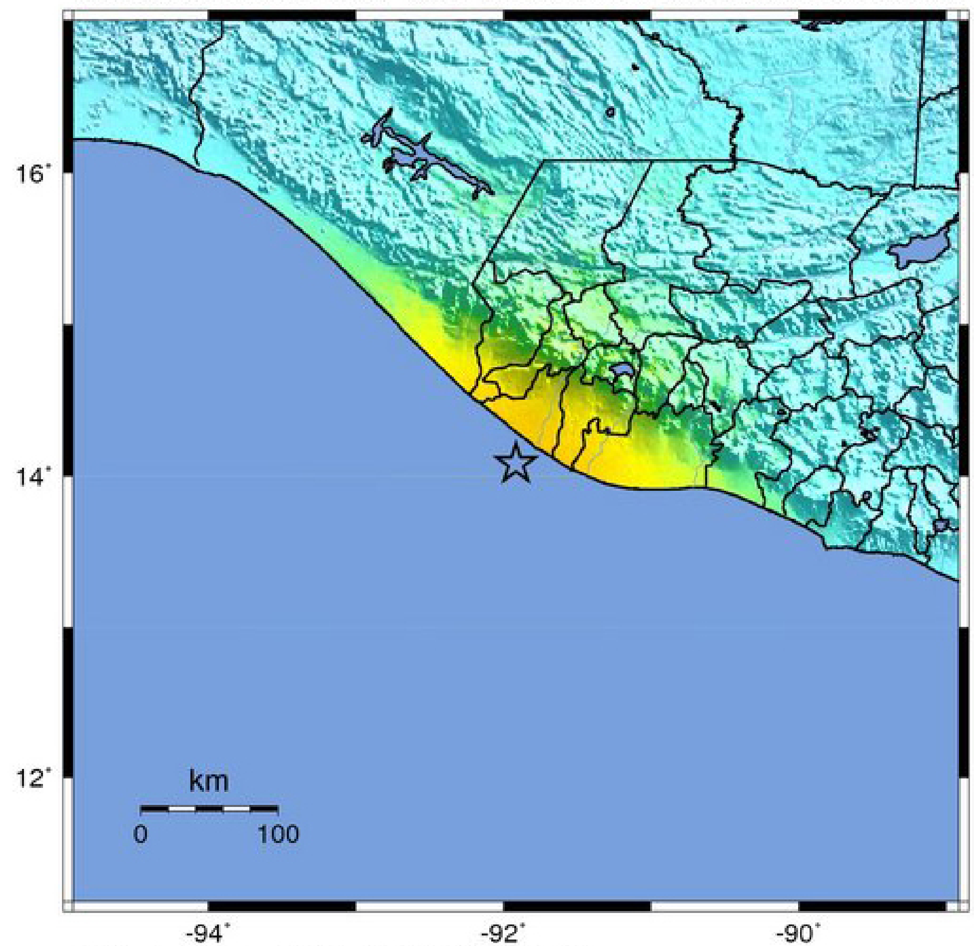
Shaking intensity scales were developed to standardize the measurements and ease comparison of different earthquakes. The Modified-Mercalli Intensity scale is a twelve-stage scale, numbered from I to XII. The lower numbers represent imperceptible shaking levels, XII represents total destruction. A value of IV indicates a level of shaking that is felt by most people. The area nearest the epicenter of this earthquake experienced strong to very strong ground shaking.

Modified Mercalli Intensity	Perceived Shaking
X	Extreme
IX	Violent
VIII	Severe
VII	Very Strong
VI	Strong
V	Moderate
IV	Light
II-III	Weak
I	Not Felt

Image courtesy of the US Geological Survey



USGS Estimated shaking Intensity from M 7.4 Earthquake

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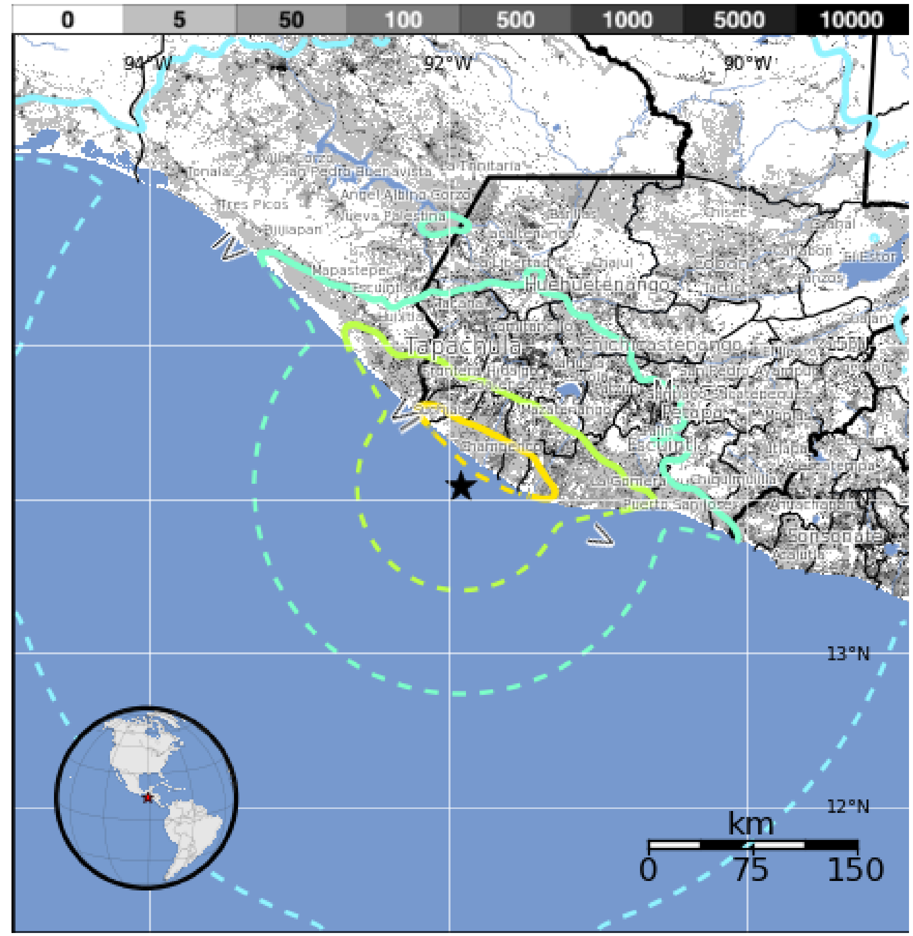
The USGS PAGER map shows the population exposed to different Modified-Mercalli Intensity (MMI) levels. MMI describes the severity of an earthquake in terms of its effect on humans and structures and is a rough measure of the amount of shaking at a given location. Overall, the population in this region resides in structures that are vulnerable to earthquake shaking, though some resistant structures exist. The predominant vulnerable building types are mud wall and concrete/cinder block masonry construction.

USGS PAGER
Population Exposed to Earthquake Shaking



The color coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table below.

Image courtesy of the US Geological Survey

Estimated Modified Mercalli Intensity	I	II-III	IV	V	VI	VII	VIII	IX	X
Est. Population Exposure	--*	147k*	12,605k	7,346k	1,929k	236k	0	0	0
Perceived Shaking	Not Felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme

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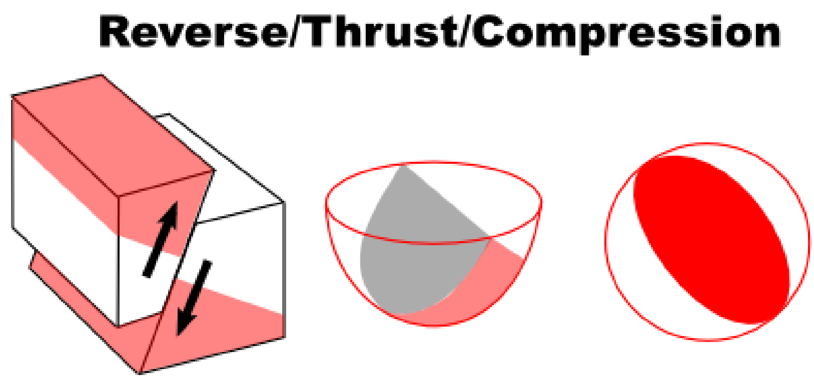
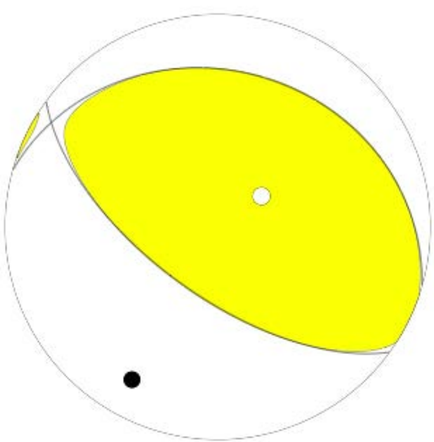
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Since an earthquake occurs as slip on a portion of the fault, it generates quadrants of compression (shaded) and extension (white) as the two sides of the fault move.

Seismologists identify the orientation of these quadrants from recorded seismic waves, and use them to characterize the type of faulting that generated the earthquake.





USGS WPhase Centroid Moment Tensor Solution

Shaded areas show quadrants of the focal sphere in which the P-wave first-motions are away from the source, and unshaded areas show quadrants in which the P-wave first motions are toward the source. The dots represent the axis of maximum compressional strain (in black, called the "P-axis") and the axis of maximum extensional strain (in white, called the "T-axis") resulting from the earthquake.

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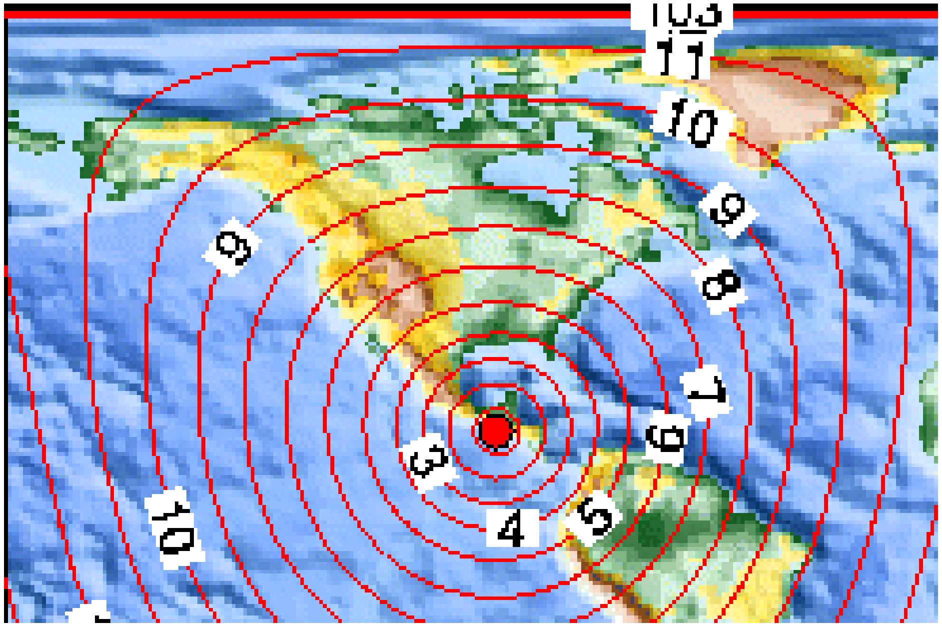
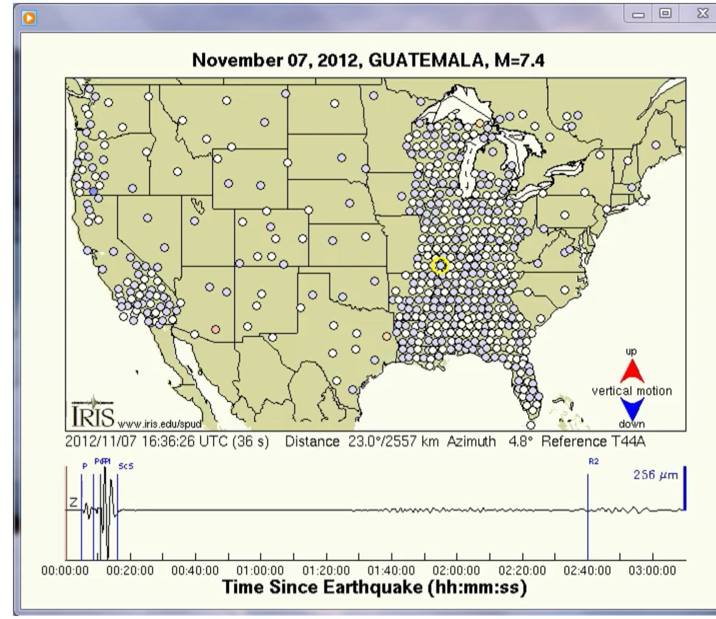


The above map shows the predicted (theoretical) travel times, in minutes, of the first (P) wave from the earthquake across the United States.

As earthquake waves travel along the surface of the Earth, they cause the ground to move. With the 400 earthquake recording stations in EarthScope's Transportable Array, the ground motions can be captured and displayed as a movie, using the actual data recorded from the earthquake.



Movie showing seismic waves crossing the US recorded by the USArray. The circles in the movie represent earthquake recording stations and the color of each circle represents the amplitude, or height, of the earthquake wave detected by the station's seismometer.

A representative trace (yellow circle is station location) is displayed on the lower part of the animation with its horizontal axis representing the time (in seconds) after the event.

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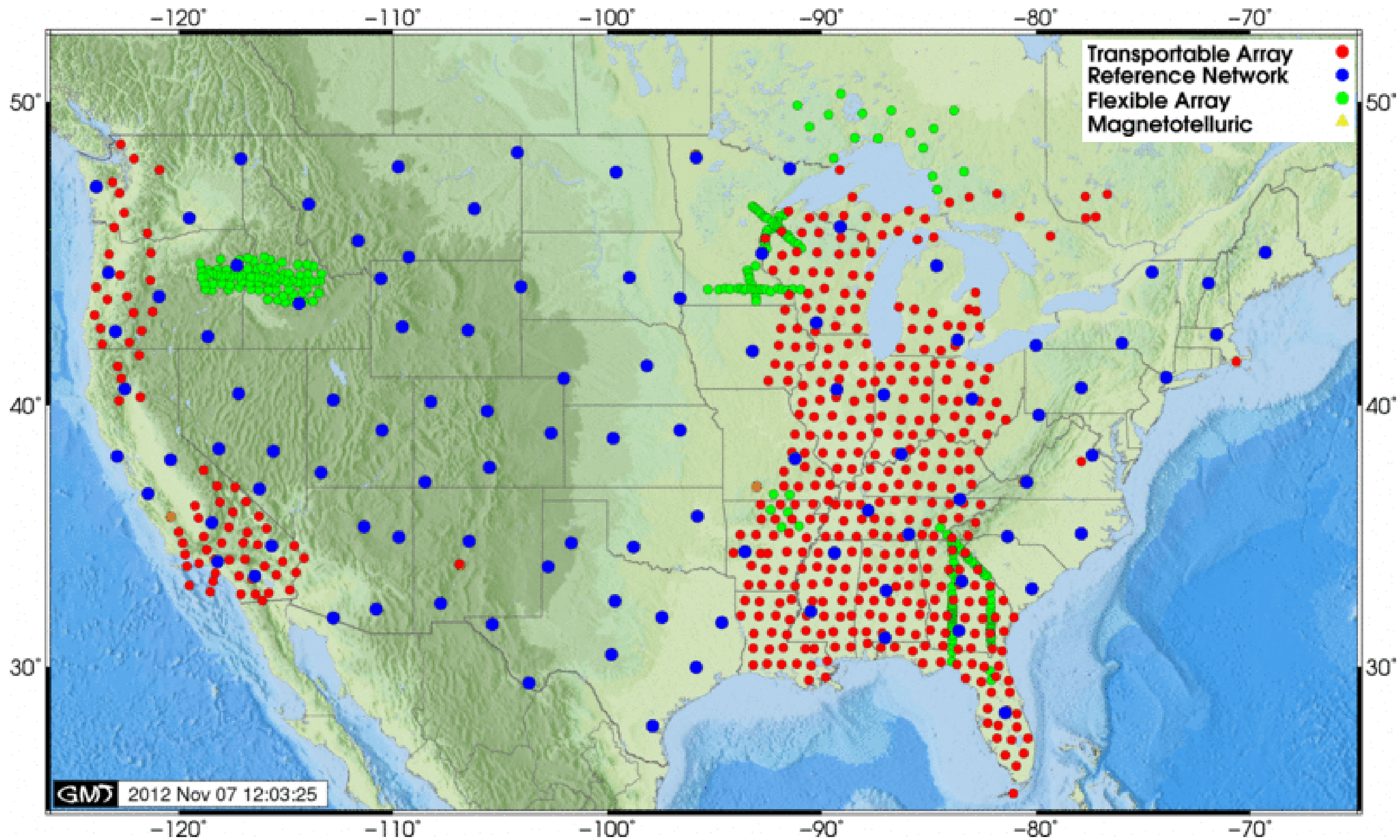
USArray: A Continental-Scale Seismic Observatory

USArray's transportable array is a network of 400 high-quality broadband seismometers that is moving (every two years) across the lower 48 states, then to Alaska, in a regular grid pattern. USArray data are being used to answer questions about the North American continent and underlying mantle.



Operating USArray Stations. The 400 active transportable array stations are plotted in red. Permanent stations are plotted in blue.

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Tectonic setting and seismic wave path animation.

IRIS Teachable Moments

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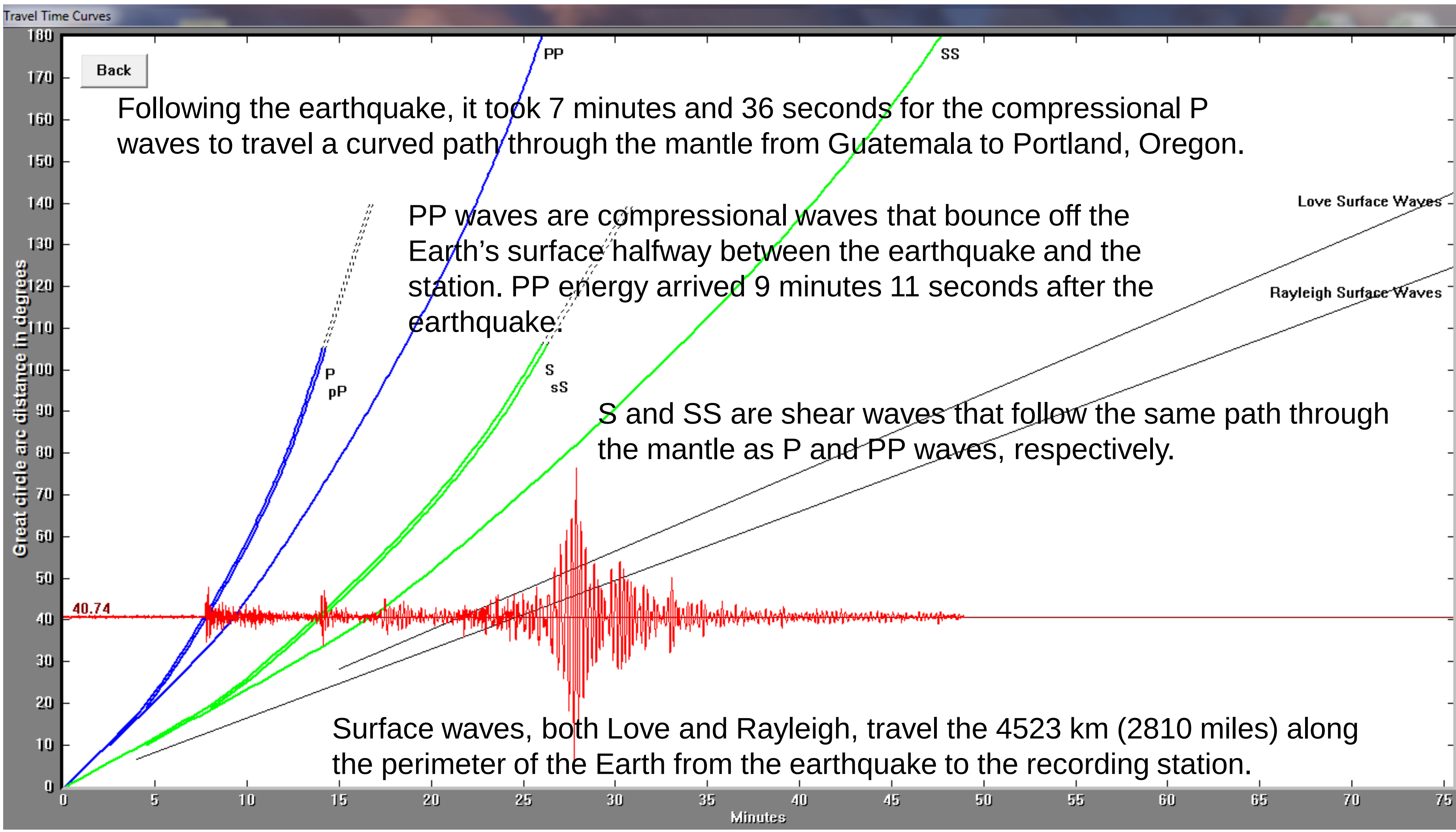
The record of the earthquake on the University of Portland seismometer (UPOR) is illustrated below. Portland is about 4523 km (2810 miles, 40.75°) from the location of this earthquake.



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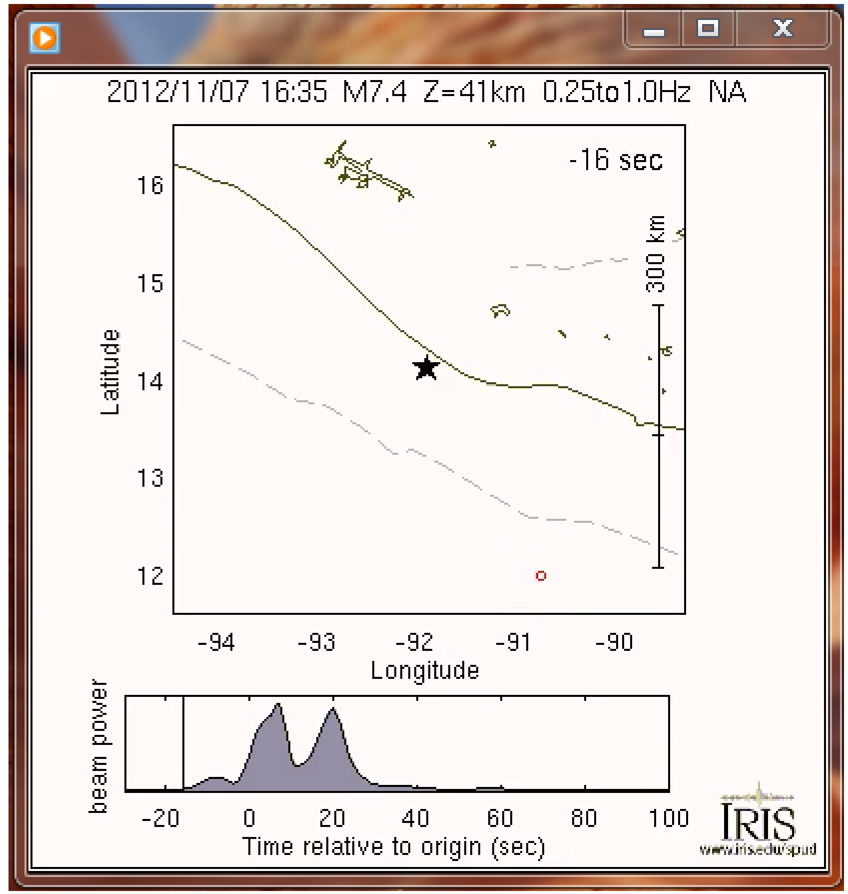
Back Projections are movies created from an automated data processing sequence that stacks up P wave energy recorded on many seismometers on a flat grid around the source region. This grid approximates the fault surface and creates a time and space history of the earthquake.

Warmer colors indicate greater beam power. In the movies, a red circle shows the location of the peak beam power when absolute beam powers are low.

Duration of rupture along the fault can be seen in the graph.



More info: http://www.iris.edu/spud/backprojection